Submitted to J. of Applied Psychology 153-259
Rec'd 1 copy 4-365

AD 709523

The Effects of Goal Setting, Rule Learning and Knowledge of Results on Performance

Edwin A. Locke and Judith F. Bryan

American Institutes for Research
Washington Office

Abstract

It was suggested that the motivational effects of knowledge of results were a function of the goal setting activity such knowledge induces. In a laboratory experiment using a computation task it was found that knowledge of total score by itself had no experimental effect on performance. However, when subjects were classified according to their a posteriori performance-goal descriptions, significant performance effects were found. In addition, subjects who accepted hard performance goals (suggested by E) performed at a higher level than subjects who set themselves other kinds of goals. Finally, the earlier subjects were able to memorize the rule needed for task performance, the higher their overall performance. Maximum rate of task improvement was associated with that experimental segment in which subjects first reported memorizing the rule.

25

The Effects of Goal Setting, Rule Learning and Knowledge of Results on Performance[1]

Edwin A. Locke and Judith F. Bryan

American Institutes for Research
Washington Office

Both Ammons (1956) and Bilodeau and Bilodeau (1961) have pointed out that the positive effects of knowledge of results (KR) on performance are well substantiated in the research literature. But both admit as well that there are few theoretical principles that would predict or explain the results obtained in any systematic fashion. Brown (19[illegible]9), in one of the few theoretical analyses performed on the topic of knowledge of results, delineated the three now well known functions of KR: (1) the reward function; (2) the information function; and (3) the motivation function. This report is concerned mainly with the last of these. A number of investigators have pointed out that KR often increases interest in the task and motivation to perform it. However, the specific mechanisms by which KR affects motivation are by no means clear. For example, a recent experiment by Chapanis (1964) demonstrated that the positive effects of KR on performance are neither certain nor automatic. Chapanis removed the "demand characteristics" (Orne, 1962) inherent in most experimental settings from his design by convincing his subjects that they were performing a regular job rather than participating in an experiment. He found that there was no effect of KR on performance in this case at all. Chapanis concludes his article as follows: "...it seems clear that the precise circumstances under which knowledge of performance can serve as a pure incentive, if indeed it ever can, need to be more clearly delineated." (p. 267).

The major hypothesis of the present investigation is that the motivational effects of KR on performance can be explained by their effects on goal setting activity. It is suggested that KR will affect performance to the extent that the subjects use such knowledge to set various kinds of performance goals. To make the argument clear it is first necessary to make an important conceptual distinction between two different types of KR. On the one hand, we can distinguish knowledge of the correctness of the individual responses or movements (KC). KC fulfills what Brown seems to mean by the information function of KR. This type of KR is most appropriately used to change one's direction of response, e.g., to correct errors, to change strategy, to make compensatory movements, etc. Examples of KC would be visual or auditory feedback in a pursuit rotor task or knowledge of the correct answer to each problem in a computation task. On the other hand, we may distinguish knowledge of the total score or total number of correct responses made over a given period (KT). This type of knowledge, because it is generally non-specific and lags in time behind performance, cannot ordinarily be used to correct individual responses, but it may be used to regulate one's level of effort or level of arousal. Examples of KT would be the time on target score in a pursuit rotor task, or the total number of problems correct on each trial in a computation task. These two types of KR are not, of course, always "pure types" in reality, but the conceptual distinction between KC and KT would seem to be a useful one. It is suggested that the motivational (intensity) effects of KR are mainly a result of KT and the directional effects mainly a result of KC. It is argued here that KT will be effective in increasing level of performance to the extent that it is used by S to set performance standards or levels of aspiration which will raise or maintain his level of effort.

The plausability of this hypothesis rests on two sources: (1) research

evidence indicating that performance goals, do in fact, affect performance level; and (2) direct evidence as to the motivational effects of KT on performance goals and performance.

There is some research support for the first assumption. Mace (1935) found that instructions to subjects to pursue different goals resulted in widely different levels of performance on a mathematical computation task. In general, he found that "do your best" instructions produced higher levels of performance than instructions to beat a score representative of S's previous performance or to beat a constant standard (e.g., of 70 computations in 20 minutes); but he also found giving S a moving standard based on his initial ability worked better than "do your best" instructions. Siegal and Fouraker (1960) found level of aspiration (as given by instructions) as to how much S was supposed to win in an experimental bargaining session was significantly related to actual winnings. Locke (1964; 1965) found that the level of intended achievement (as manipulated by instructions) had a significant, positive, linear relation to actual level of performance on a series of brainstorming tasks. Finally, Locke and Bryan (1965) found that giving subjects hard performance standards produced a higher level of performance on a complex psychomotor task than "do your best" instructions.

Studies demonstrating the relation of knowledge of total score to goal setting activity and performance are fewer in number but suggestive. Mace (1935) found that on a target aiming task, when KT (knowledge of total score) was introduced, performance improved immediately and when KT was removed, performance declined. (All subjects had knowledge of the correctness of each "throw" from visual feedback.) Mace claims that the KT suggested appropriate performance standards to the subjects which resulted in a more sustained level of effort than was the case without them. Payne and Hauty (1955) gave some subjects

knowledge of their total score in relation to a standard. These subjects were told that the standard represented the typical performance "of subjects like you," but actually it was one standard deviation above this point (so that the subject would be expected to beat it only 16% of the time). These subjects performed at a significantly higher level than subjects given no such knowledge of score. Although the subjects given KT in relation to a standard were not told explicitly to try and beat the standard[2], the implication was clear that they should. Finally, Church and Camp (1965) gave subjects Yes-No KR on a reaction time task to indicate whether or not they had beaten a score based on their own previous performance and found that these subjects reduced their RT's more than subjects given no such KR. Again, KR were given in terms of a standard, rather than as just "raw" scores and this may explain their effectiveness. (Note that in this experiment KC and KT were "the same;" actually in an RT experiment there can be no real KC as there is no such thing as a "correct" reaction time.)

If it is true that the motivational effects of KT are a function of their effect on goal setting activity, then we would expect that subjects' goals set "spontaneously" on the basis of KT would be systematically related to their performance, whereas KT should have no motivational effect independently of its effect on goals. The present experiment was designed to explore this hypothesis. A second purpose of the experiment was to compare performance under various KT conditions (for whatever goals were set under these conditions) with performance under conditions where hard performance standards were given by instructions . Previous work by Locke and Bryan (1965) suggested that this would yield a higher level of performance than other type goals that subjects might pursue (e.g., "Do as well as possible").

A final purpose of this study was to determine the effect of another

cognitive component--the learning of rules relevant to the task--on performance. Haygood and Bourne (1965) have shown previously that rule learning is highly related to task performance in concept formation tasks. Similar studies in the area of verbal learning and awareness (e.g., see Spielberger, 1965, for a review) have shown that awareness of the rule E uses to "reinforce" S, results in an immediate and marked performance gain. The present investigators explored the generality of these findings with a different task and with a far more complex rule (see footnote 3) than has been used in previous studies.

Method

<u>Task</u>. The task was the Complex Computation task used previously by Mace (1935). The subject is presented with a series of four digit numbers. For each one he must perform a series of operations according to certain rules[3] and come out with the answer, performing all the operations in his head (only the answer is written). The task requires intense concentration and shows considerable learning.

All subjects were given two 2-minute practice trials on the task followed by 6 experimental trials of 10 minutes each. There was one work sheet for each experimental trial containing 144 different problems.

<u>Subjects</u>. The subjects were 70 University of Maryland students who responded to a college newspaper advertisement offering money for participation. Twenty-seven subjects were female and 43 were male.

<u>Conditions</u>. There were three experimental conditions to which the subjects were assigned at random. Twenty-six subjects were given specific performance standards to aim for on each experimental trial (STD group). These standards were set by adding an increment of 15 to the highest number correct attained on any previous trial. (For trial 1 the standard was 5 times the second practice trial score plus 15). The standards were meant to be hard to reach. Twenty-five subjects

were allowed to compute the total number of problems they got correct at the end of each trial and to write that number at the bottom of the page but were given no standards (KR group). Finally, 19 subjects were not allowed to compute their total number correct and were explicitly told to refrain from trying to count them (No KR group). Both the latter groups were told to "do their best" on each trial.

All subjects were given knowledge of the correctness of each answer, since at the end of each trial E read off the correct answers to each problem. In the STD and KR groups, subjects kept track of their scores by circling each correct answer and totaling them up. In the No KR group, subjects were not allowed to circle their correct answers nor to total them; they simply followed E as he read the answers by looking at their own answers. Of course, these subjects could not be prevented from obtaining knowledge of progress implicitly, but such knowledge could not be very precise.

Procedure. The experiment was introduced as a study of computation learning. Subjects were handed out a booklet of work sheets, the first page of which contained three sample problems and enough additional problems for two 2 minute practice trials. They were then given 3 x 5 index cards with the computation formula on them. The formula was explained and the three sample problems were done by E, step by step. Then, all subjects worked for two minutes on the first practice trial doing "as many as they could." After this the correct answers were given and subjects worked on the second practice trial for 2 minutes, after which the correct answers were read again for each problem.

At this point the STD group computed their total number of problems correct on the second practice trial and set their standard for experimental trial 1, and wrote that standard at the bottom of the work sheet for trial 1. The KR group simply computed their total correct on this trial and wrote this

number at the bottom of the page. The No KR group did nothing (they were told to "rest"). This same procedure was followed for each group for each subsequent trial. The intervals between trials were the same for all groups but were not equal to each other (due to difficulties in making the STD subjects understand the goal setting procedure at first). The between-trial intervals ranged from 4 to 7 minutes.

At the end of trial 6 all subjects were asked to describe their performance goals in detail. Sample goals (e.g., "tried to do my best;" "I tried to improve each time;" "I had no goals," etc). were given in each case to make the meaning of the question clear. In addition, the No KR subjects were asked to what degree they had knowledge of their total score (number correct on each trial) during the experiment. After this the subjects were asked if they tried "more for accuracy," "more for speed" or for "both the same" during the experimental trials. They were also asked if they had been able to memorize the computation formula, and if so, on what trial.

Results

Analysis by Experimental Conditions

The first analysis was done using the experimental groups as units. The E's re-scored all protocols for the STD and KR groups in addition to scoring the No KR protocols. Two criteria were used: the total number of problems solved correctly on the 6 experimental trials, and the total number of problems attempted on the same trials. There was no significant experimental effect for either criterion (F's=1.30 and 1.82, respectively; df. 2;66) nor were there any significant differences between individual groups. These findings are not too surprising in view of the fact that no *a priori* assumptions could be made about the goals of the various groups (with perhaps the exception of the STD group, and even this assumption turned out to be wrong as we will see below).

To further check the generality of these findings the No KR group was broken down on the basis of their responses to the post-experimental question asking them how much knowledge they had about how well they were doing overall (i.e., their knowledge of their total scores on each trial). The subjects were divided into two groups: those who had a "fair or good" idea of how well they were doing (N=7) and those who had a "very rough idea" or "no idea" of how well they were doing (N=11). One subject's responses could not be interpreted and was dropped from this analysis. There was no significant difference between the mean number correct of these two groups ($t < 1$).

Analysis by Reported Performance Goals

Goal Classification. The post-experimental goal descriptions of the subjects were examined to see if they could be divided into homogeneous groups. Interestingly, only five subjects in the STD condition indicated they were trying to reach the goals set by E[4], so these subjects were immediately classified as "STD" subjects. The remaining subjects fell into three groups: (a) Improvement (IMP): subjects in this group indicated that their main goal during the experiment was to improve over their best previous score or to improve as they went along. A few mentioned trying to improve by a specific amount (e.g., 5 points); most did not. None indicated they were trying to improve by as much as 15 points each time (i.e., as were the STD subjects); (b) Do Best: subjects in this group indicated that they were predominantly trying to "do their best" or "do as many as possible" and did not mention trying for any specific standard; several said explicitly that they paid no attention to their previous scores; (c) Other (low motivation): all remaining subjects were put into a residual group. All subjects in this group seemed to be trying less hard than those in other groups (e.g., "I was indifferent"). Some were trying for awhile to "do their best" and then relapsed (e.g., "I

tried, at first to do my best. After about trial 3, I became bored and was merely working along."). Others were trying for accuracy only, and still others listed 3 or 4 different goals (which applied to different trials) ranging from "none" to "do best."

The present investigators first developed the categories together, wrote descriptions of them, and re-classified all subjects using the descriptions (with only 2 or 3 disagreements). To check on the reliability of this classification, one naive rater was given the category descriptions and told to classify the subjects from their goal descriptions. This rater agreed with the E's on 57 of the 70 protocols initially. Eight additional disagreements were due to his not understanding the goal statement because he did not understand the experimental design and task well enough to interpret them. When these were explained, he classified them as the E's did. This left only 5 of the 70 that he could not classify. The two E's re-examined these and classified them. It appeared at this point that further reliability checks would not prove fruitful. Most of the goal descriptions were easy to classify and the few that were hard would have been hard for anyone.

<u>The Relationship of Goals to Performance</u>. Table 1 shows the number of subjects in each experimental condition who were placed in each goal classification. In addition the mean number of problems solved correctly for each sub-group are shown. It is evident that the "SED" goal subjects showed the highest performance level, the "Do Best" subjects the next highest and the "Improvement" and "Low Motivation" subjects the lowest. The means for each goal sub-group are fairly consistent across the different experimental conditions, with the possible exception of the Improvement subjects from the KR group who showed exceptionally high scores. However, these can be partially accounted for by the higher mean practice scores (i.e., ability) of this group of Improvement

subjects as compared with the others. For purposes of analysis, subjects with similar goals were combined across experimental conditions. The mean total number of problems correct for each of the 4 goal groups as a whole, are shown in the last column of Table 1. Before testing the differences of these means, to test for differences in initial ability, an F test was done on the practice trial scores (for the two practice trials combined) for these groups for two criterion measures: (a) total number correct, and (b) total number attempted. The F was not significant for either criterion (F=1.68, 1.90, respectively; d.f. 3;66) indicating no overall difference in initial ability between the 4 goal groups.

Insert Table 1 about here

F tests were performed on the performance scores of the 4 goal groups using 3 different criteria: (a) total number correct; (b) total number attempted; and (c) the individual linear slope scores for number correct from the practice trials to trial 6 (the practice score was taken as 2.5 times the sum of the number correct on practice trial 1 and 2, to control for the difference in trial length on the practice and experimental trials). Each of the three criteria yielded significant overall F ratios; they were 5.99 ($p < .01$) for total correct; 6.01 ($p < .01$) for total attempted; and 4.11 ($p < .01$) for the linear slope scores (d.f. 3;66 in all cases). The corresponding F values including only the EMP, Do Best, and Other groups are 3.07 ($p < .06$), 4.14 ($p < .05$) and 2.71 (n.s.), d.f.'s 2;62. For all three criteria, the STD group showed the highest scores and the Other group the lowest. For the first two criteria the Do Best group was second and the EMP group third; for the last criteria, these two groups were barely reversed.

Individual comparisons were also made between the means of each group.

The results of these t-tests are shown in Table 2 for each criterion measure. No significance labels have been placed on these t-values as they would be meaningless in view of the large number of tests made (the usual multiple comparisons tests, e.g., Tukey, were precluded by the wide variation in the N's of the goal groups). Rather, they are simply useful to reveal the relative size of the differences between the various means.

Insert Table 2 about here

It is clear that in practically all cases the differences between the Standard and the remaining three groups are substantial, suggesting that trying for hard standards will lead to higher level of performance than the types of goals that will ordinarily be set if just knowledge of results are given. As an indication of the relative difficulty of the goals in the STD and IMP groups, the STD subjects were able to beat their standards (i.e., beat their best previous score by at least 15) only 13% of the time, whereas the IMP subjects were able to beat their standards (i.e., beat their best previous score by at least 1) 70% of the time. Since previous findings (e.g., Locke, 1965) have shown goal difficulty to be positively related to level of performance (providing the subjects accept the goals), the reason for the difference between the two groups in this case seems clear. Unfortunately, similar difficulty estimates could not be made for the Do Best or Other goals. However, the Do Best goal seems to have resulted in higher performance than the "Other" goal. There is some superiority of the Do Best goal to the Improvement goal, but it is not consistent across the different measures.

The four goal groups were also compared according to their within trial slopes. After each two minutes of the experimental trials subjects were asked to draw a vertical line after the problem they had most recently finished.

This enabled a count to be made of the mean number correct for each two minute segment for each of the goal groups. No significant differences were found in the within trial slopes of the different groups. Whatever differences there were in the overall mean scores of the four groups were about equally large for each two minute segment of the 10 minute trials.

A final a posteriori grouping of the subjects was done on the basis of the one additional post-experimental goal question. Subjects were asked to indicate whether they had been trying more for speed, more for accuracy or about equally for both on the experimental trials. Those who claimed they were trying more for speed did not attempt significantly more problems than the other two groups, nor did those who indicated they were trying more for accuracy show a greater mean percent of answers correct than the other two groups, as might have been expected. Thus, the further breakdown by goals did not yield any consistent performance effects. The implications of this finding are not particularly clear, as it was not determined just how much the various subjects were trying more for one of these goals (e.g., speed) than another (e.g., accuracy).

The Effect of Rule Memorization

At the end of the experiment subjects were also asked whether or not they had been able to memorize the computation rule before the end of the last experimental trial, and if so, during what trial they had memorized it. It was hypothesized that memorization of the rule would facilitate task performance, since the subjects would not have to keep referring to the card all the time and thus take their eyes off the problem at hand (and perhaps lose concentration). Subjects were re-classified into four groups according to when they indicated they had first memorized the formula: trial 1 or 2, (N=17); trial 3 or 4, (N=28); trial 5 or 6, (N=12); or "Not at all" (N=12). One subject was dropped from the

analysis at this point for failing to indicate when he had memorized the formula.

Since there were significant differences among the "total correct" means of these groups in the practice trials ($F=5.74$; $p < .01$, d.f. 3;65), an analysis of covariance procedure had to be used in determining the memorization effects. The corrected means of the four groups and the overall F test results are shown in Table 3. It is evident that the mean total correct scores are in the exact order one would expect: the earlier the subjects memorized the formula, the better their total performance. The overall F, corrected for initial ability level, was 5.47 which is significant at the .01 level.

Insert Table 3 about here

It was also of interest to determine whether or not subjects showed relatively greater improvement on the trial during which they memorized the formula (or the one immediately before or after) than on other trials. If memorizing the formula were a relatively discreet process, we would expect a "jump" in performance at the time of memorization or shortly before or after; in addition, the jump at this point for this group should be higher than the jump for the other groups and higher than the jump for the same group on other segments. To test these possibilities the linear slope scores were computed for each memorization group (omitting the No Memory group) for three overlapping experimental segments: from the practice trials (2.5 times the sum of the two trials) to trial 2; from trial 2 to trial 4; and from trial 4 to trial 6. Each segment, therefore, includes the two trials during which the members of one of the first three memorization groups memorized the formula and one trial before it. We would expect that each memorization group should have its highest slope on the segment during which its members first memorized the formula; i.e., there should

be an interaction between memorization group and experimental segment. These pure interaction scores (i.e., slope scores after correction for row and column means) are shown in Table 4. The relevant interactions for our purposes (those for corresponding memorization groups and experimental segments) are italicized. Note that all three interactions are the highest in their column and two out of the three are the highest in their row. Thus, the greatest relative increase in performance both within and between groups appears to have occurred in the segment in which subjects reported memorizing the formula. Testing the significance of this interaction is made difficult by the overlapping slope scores and the unequal N's of the memorization groups. Using the method described by Winer (1962, p. 374 ff.) for a two factor design with repeated measures on one factor and unequal group size yielded an interaction between memorization group and segment significant at the .01 level ($F=3.88$, d.f. 4,108).

Insert Table 4 about here

Discussion

It appears that giving subjects knowledge of total score does not result in any automatic gain in performance. Rather, our results suggest that it is what S does with that knowledge, i.e., what kinds of performance goals he sets with it that is important. Thus, in answer to Chapanis' comment quoted earlier, we can suggest as a possible answer: that knowledge of performance (total score) will improve performance to the degree that it is used by S to set performance goals, depending on the difficulty or nature of those goals. Some subjects use KT to set performance goals such as "Improvement" or "Do Best." Others, however, do not set such high goals and hence do not perform as well as the former. The present investigators would argue that there is no way, as

yet, of predicting what goal S will set in response to KT from aspects of the situation alone (i.e., from the mere fact of knowledge of total score).

We cannot make unequivocal conclusions about the relative effectiveness of the goals of Improvement and Do Your Best on the basis of this study. Previously Mace (1935) found Do Your Best goals to result in higher performance than Improvement goals, using total number of correct computations as the criterion. In the present investigation this was true to a limited degree for the total correct criterion, to a greater degree for the total attempted criterion, and not at all for the linear slope criterion. More certain conclusions about the relative effectiveness of these two goals will have to await further research. It does seem clear, however, that the Do Best goal will lead to a higher level of performance than such goals as "did not try to improve;" "just tried to get it over with;" "had no goal at all;" etc. which characterized the "Other" group in the present study. Future investigations might explore in more detail the various types of "Low Motivation" goals that subjects set. In more realistic (field) settings, it is quite likely that more subjects will have relatively "easy" or "low" goals than was the case in the present study where the "demand characteristics" of the setting were high (since it was an "experiment").

Of considerable interest in the present case was the finding that setting determinate and hard performance standards resulted in considerably higher performance than other types of goals (e.g., "Do Best"). This replicates a similar finding by Mace (1935) using a simpler computation task than the one used here, and with 12 year old boys as subjects, as well as an earlier study by the present investigators (Locke and Bryan, 1965) using a psychomotor task. This suggests that subjects will not ordinarily perform at as high a level as

they are capable of doing if given very hard goals even though they might be "trying their best" under these other conditions.

Finally, the effect of rule learning on task performance was shown to be considerable in the present study. The earlier subjects were able to memorize the rule required for performing the task, the better their performance. In addition, their performance appeared to improve most rapidly (in comparison to other groups on the same segment and to the same group on other segments) during the segment on which they first memorized the rule. This supports previous findings in widely different areas (e.g., attribute learning and verbal learning and awareness) where it has been shown that the learning of the rule or principle governing proper task performance (e.g., the rule by which objects are classified or the rule by which reinforcements are given) leads to marked and immediate improvement in performance.

One difference between this and previous studies, however, was that in the experiments by Haygood and Bourne (1965) and Spielberger and his associates (1965), it was shown that the discovery of the rule led to a better performance. In these cases, the rules were relatively simple to remember and apply. In the present case the subjects were given the rule at the outset, but it was complex enough so that it could not be memorized right away. The results demonstrated that the degree to which S learned (memorized) the rule was an important factor in performance, thus demonstrating the wider applicability of the previous findings.

All the results obtained here point to the general importance of cognitive aspects of learning and performance. A number of investigators have been giving such aspects increasing attention in recent years (e.g., Haygood and Bourne, 1965; Locke and Bryan, 1965; Miller, Galanter, and Pribram, 1960; Ryan, 1965;

Spielberger, 1965) and it would seem that such attention is merited by an increasing number of experimental findings.

Footnotes

1. This research was supported by Contract No. Nonr 4792(00) between the office of Naval Research and the American Institutes for Research. The opinions expressed are not necessarily those of the Department of the Navy.

2. Personal communication from Dr. R. B. Payne, June 9, 1965.

3. "Call the four digits A, B, C and D. If A is greater than B, multiply A by B; if A is less than B, add A to B. If C is odd, multiply C by D; if C is even, add C to D. If both of the previous operations were the same (i.e., both add or both multiply), subtract the first result from the second; if the two previous operations were different (i.e., multiply and add or vice verse) subtract the second result from the first. Write the answer."

4. In previous research (Locke, 1965; Locke and Bryan, 1965) we had gotten subjects to accept such goals by telling them that they "represented what we considered to be a successful performance on the basis of our experience with the task and represented somewhat above the average performance." In the present experiment we wanted to see whether subjects would accept such goals without this additional explanation. In the present case we simply told them that the standards were there to "help them learn the task better." Evidently this was not a sufficient incentive to make them accept goals which were quite difficult to reach.

References

Ammons, R. B. Effects of knowledge of performance: a survey and tentative theoretical formulation, Journal of General Psychology, 1956, 54, 279-299.

Bilodeau, E. A. and Bilodeau, I. McD., Motor-skills learning, in Annual review of psychology, Palo Alto: Annual Review, Inc., 1961, 243-280.

Brown, J. S. A proposed program of research on psychological feedback (knowledge of results) in the performance of psychomotor tasks. In research planning conference on perceptual and motor skills. San Antonio, Texas: Human Resources Research Center, Lackland Air Force Base, 1949 (Conf. Rep. 49-2) Pp. 81-87.

Chapanis, A. Knowledge of performance as an incentive in repetitive, monotonous tasks, Journal of Applied Psychology, 1964, 48, 263-267.

Church, R. M. and Camp, D. S. Change in reaction time as a function of knowledge of results. American Journal of Psychology, 1965, 78, 102-106.

Haygood, R. C. and Bourne, L. E., Jr. Attribute and rule-learning aspects of conceptual behavior. Psychological Review, 1965, 72, 175-195.

Locke, E. A. The relationship of intentions to motivation and affect. Unpublished Ph.D. dissertation, Cornell University. 1964.

Locke, E. A. The relationship of intentions to level of performance. Journal of Applied Psychology, 1965, (in press).

Locke, E. A. and Bryan, J. F. Cognitive aspects of psychomotor performance: the effects of performance goals on level of performance. American Institutes for Research (unpublished), Silver Spring, Md., 1965.

Mace, C. A. Incentives: some experimental studies, Industrial Health Research Board (Great Britain), 1935, Report No. 72.

Miller, G. A., Galanter, E., and Pribram, K. H. Plans and the structure of behavior, New York: Henry Holt, 1960.

Orne, M. T. On the social psychology of the psychological experiment with particular reference to demand characteristics. American Psychologist, 1962, 17, 776-783.

Payne, R. B. and Hauty, G. T. Effect of psychological feedback upon work decrement. Journal of Experimental Psychology, 1955, 50, 342-351.

Ryan, T. A. Chapter I: Explaining behavior; Chapter II: Explanatory concepts; Chapter V: Experiments on intention, task, and set; Chapter VI: Intentional learning; Chapter VII: Unintentional learning. Cornell University, Dept. of Psychology, (unpublished mimeos), 1965.

Siegal, S. and Fouraker, L. E. Bargaining and group decision making, New York: McGraw-Hill, 1960, pp. 61-69.

Spielberger, C. D. Theoretical and epistemological issues in verbal conditioning. In S. Rosenberg (Ed.) Directions in psycholinguistics, 1965 (mimeo draft).

Winer, B. J. Statistical principles in experimental design, New York: McGraw-Hill, 1962.

Table 1

N and Mean Total No. Correct for Each Goal Group by Condition

A Posteriori Goal	Measure	Experimental Condition			Mean Total Correct	N
		Standard	KR	No KR		
Standard	n # correct	5 352.2	-- --	-- --	352.2	5
Improvement	n # correct	11 190.5	9 25[illegible].1	4 154.5	207.2	24
Do Best	n # correct	6 249.8	5 27[illegible].2	6 256.8	260.1	17
Other (low motivation)	n # correct	4 211.8	11 20[illegible].8	9 174.6	194.6	24
Total	n # correct	26 238.5	25 2[illegible].8	19 196.3	226.1	70

Table 2

Multiple Comparison Results for Performance Means

of *A Posteriori* Goal Groups for Three Criteria

Criterion	Comparison[a]					
	STD-Other	STD-IMP	STD-Best	Best-Other	Best-IMP	IMP-Other
Total Correct	4.23	3.41	1.99	2.43	1.62	b
Total Attempted	4.18	2.84	1.72	3.06	2.09	b
Linear Slopes (# Correct)	3.08	1.13	2.56	b	-b	1.71

[a] In all cases the group listed first at the top of each column had the higher mean, except where a minus sign precedes the result.

[b] t-test not performed; consider t as being < 1.

Table 3

Mean Total No. Correct for Four Memorization Groups

Memorization Group (trial when first memorized formula)	Mean Total Correct[a]	Between Group F[b]	d.f.	p
1 or 2	277.4			
3 or 4	2[illegible]1.3	5.47	3;64	.01
5 or 6	19[illegible].7			
Not at all	[illegible]			

[a] corrected for initial ability

[b] analysis of covariance, controlling for initial (practice trial) ability

Table 4

Interactions of Memory Group with Experimental Segment
(Linear Slope Scores for No. Correct)

Memorization Group	Experimental Segment		
	Prac-Trial 2	Trials 2-4	Trials 4-6
1 or 2	+3.14[a]	-2.15	-0.98
3 or 4	-1.20	+1.16	+0.05
5 or 6	-1.93	+1.00	+0.93

[a] a positive score indicates a group was above the mean for its row and column.